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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19, 1891. No response to date.

N. D. C. HODGES, 874 BROADWAY, N. Y.

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NEW YORK, DECEMBER 22, 1893.

CURRENT NOTES ON ANTHROPOLOGY—NO. XXXVI.

(*Edited by D. G. Brinton, M. D., LL. D., D. Sc.*)

THE WOMAN'S ANTHROPO_OGICAL SOCIETY OF WASHINGTON.

IT is pleasant to record that this Society held its one hundredth meeting in January, 1893; and in memory of this interesting occasion, it has issued a modest pamphlet with a sketch of its industry since its organization in 1885. It has had three presidents, Mrs. Tilly E. Stevenson, Mrs. Carter and the present incumbent, Miss Alice C. Fletcher. The Society is divided into six sections, occupied respectively with the six branches, archæology, child-life study, ethnology, folk-lore, psychology and sociology. This division might be open to some question, especially as to the distinction between ethnology and sociology; but if it is found to be a good working basis, that is enough. The finances are reported in a flourishing condition, and the attendance, as well as the membership, reveals a steady advance.

So far as I am aware, there is no other anthropological society composed exclusively of women; although there are distinguished anthropologists of the female sex in many countries. It seems contrary to the true spirit of science for any scientific society to be composed exclusively of one sex. The pursuit of truth, especially that of general laws by inductive methods, should be epicene, and severed from all sex relations. The result of the opposite course in this instance is indicated by the fact that three-fourths of this report are taken up with an article on "The Woman's Movement." Good indeed, but much better fitted for a political congress than an anthropological society. When women become scientists, they should for the time forget sex in the search for truth.

THE PALAEO-ASIATICS.

THIS is the name given by some ethnographers—Russian and German—to a number of tribes, including the Kamschatkans, Ghiliaks, Koriaks, Youkagirs, etc., now inhabiting the islands and extreme northern and eastern coasts of Siberia; the theory being, that at one time their ancestors occupied most of northern Asia and the Japanese Archipelago, but were dispossessed by the Chinese, Mantchu, and other Mongoloid peoples. They are small in stature (about 1.50—1.60), strongly built, head round, nose flat, eyes small and oblique, hair straight, beard scanty.

Some interesting studies bearing on this question have been recently issued by Professor Gustave Schlegel, of Leyden, to whose fruitful researches in the Chinese annals I have before alluded (see *Science*, Sept. 9, 1892, March 24, 1893). He advances cogent reasons for believing the "Land of Little Men" of these ancient chronicles was Japan, and the small people from whom it derived its name were the Koriaks, who, he argues, inhabited these islands before the arrival of the Ainos, and were driven out by them. He supports this by the archæological observations of Prof. E. S. Morse, which point in this direction. The Ainos themselves, he inclines to think, are the nation referred to in the Annals as the inhabitants of "The Land of White People," and connects them with the European white race, both from the color of their skin, the character of their hair, and their full beards, traits which distinguish them broadly from their Mongolian neighbors.

Other identifications suggested by Professor Schlegel are the "Land of Gentlemen" with a part of Corea; the "Land of the East" with Kamschatka; the "Land of Profligate Devils" also with Kamschatka; and the "Land of Tall Men" with the islands of the Ainos.

THE ETRUSCAN PROBLEM.

THAT in the centre of the classic world a nation arose, attained a high state of civilization and remarkable artistic and literary culture, flourished for five hundred years, then disappeared, leaving some of the grandest monuments of history, and thousands of inscriptions and extensive texts in its language,—and yet that modern scholars have been unable to decipher positively a word of this language, or discover an affinity with any other nation or race,—this is certainly an unique example.

The efforts are, however, bravely continuing.

In a little-known provincial journal, the *Zeitschrift des Insterburger Alterthumsverein*, 1893, Heft III, Dr. G. Kleinschmidt has an article headed, "Zwei Lemnische Inschriften," undertaking to show that the two well-known inscriptions from the island of Lemnos, in Etruscan characters, can be interpreted by the Lithuanian and Lettish languages. As these are pure and ancient forms of Aryan speech, his argument has just as much in its favor as those of the great Etruscologist Deecke, who also claims Etruscan as an Indo-Germanic tongue.

Quite opposed to that view is the opinion—not novel—of Signor Gaetano Polari, who in a brief paper called "The New Etruscology," printed at Lugano, urges and illustrates the similarity of Etruscan to the Basque language.

Approaching the question from the side of physical anthropology, Professor Giuseppe Sergi, of Rome, in a careful article in the *Nuova Antologia*, Sept., 1893, announces that a prolonged and minute study of the genuine Etruscan remains of skulls, etc., throughout Italy, has convinced him that beyond doubt they must be classed with the Lybian stock, of North Africa. He will shortly bring out the technical demonstration of this. It gives me a natural pleasure to mention this, as the many points of similarity between the culture, religion and languages of these two peoples were first pointed out by myself,—as Professor Sergi kindly acknowledges.

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Parole della Verita," in its various forms; on a peculiarity of the Book of Tobit; on the Novelle of Cieco da Ferrara; on the Apologue of Menenius Agrippa, etc. All of these show extensive reading and sound critical judgment.

FALL MEETING OF THE ALABAMA INDUSTRIAL AND SCIENTIFIC SOCIETY.

In December, 1890, this society was organized "for the promotion of the scientific examination and discussion of various questions of interest to the material progress of the state." The last meeting of this society was held in Birmingham on Nov. 24, when several papers of considerable interest were presented.

Mr. Murray, of the Linn Iron Works, described an improvement made by him in boilers. This improvement consists in the use of a double decked boiler with a mud drum below, and a further improvement was a modification of the Speerman-Kennedy gas burner. Mr. A. E. Barton, Superintendent of the Ensley Furnaces, read a paper "On the Grading of Southern Pig-Iron," in which he discussed the change from the old method of fifteen grades to the present one of eleven grades. He also emphasized the necessity of frequent analyses of the furnace products as an aid to the proper grading.

Mr. Erskine Ramsay, Mining Engineer at the Pratt Mines, and President of the Society, read a paper "On the Use of Coke Oven Gases and Heat in the Generation of Steam." The system in use at the Pratt Mines, which has been very carefully worked out by Mr. Ramsay, has resulted in considerable economy. The coke ovens are provided with a gas flue running the entire length of the battery through which the gases are delivered under the boilers. Mr. Ramsey showed that the heat thus utilized was merely the waste heat of the coke ovens, and that none of it was due to the combustion of the gases themselves. Attempts to utilize the heat of combustion were not successful.

Dr. William B. Phillips, consulting chemist of the Tennessee Coal, Iron and Railway Company, read a paper on the "Improvement of the Iron Ores of the Birmingham District," in which he described certain processes which he has for some time been investigating, by which it will be possible to free the red ores of the Clinton or Red Mountain formation from the greater part of the silica, as well as from most of the phosphorus. The freeing of the iron from the silica is effected by means of an electromagnet, the ores having been previously magnetized by heating them in an atmosphere of combustible gas. Operating upon 3,000 pounds at a time, the crude ore, which contained 40 per cent of iron and 29 per cent of silica, was so improved as to yield 57 per cent of iron and only 10 per cent of silica. In some cases even better results than this have been obtained. The success of these experiments has induced the company to make a test on a large scale in one of their furnaces in Bessemer, and if successful there also (and of this there seems to be no reasonable ground for doubt), a vast amount of ore will at once become available, which is now thrown aside because carrying from 25 per cent to 35 per cent of silica.

Mr. H. F. Wilson, Jr., described some work of his in tracing the great seams of ore along the Red Mountain on both sides of Grace's Gap, illustrating his remarks by some handsome drawings and sections. This paper was a valuable supplement to that of Dr. Phillips.

The financial depression of the last year or two has left its impress upon the society, but at this last meeting nine new members were elected, and a marked increase of interest was shown in the number of papers presented and in the discussions which followed.

ALABAMA GEOLOGICAL SURVEY.

The field work of the geological survey during the past season has been in the gold region of Coosa, Talladega, Tallapoosa, Cleburne, Randolph and Clay Counties. Before the discovery of gold in California a great amount chiefly of placer work was done in Alabama, and many thousands of dollars' worth of gold raised. This work was almost suspended when the new fields of California were brought to notice, for the gold miners of Georgia and Alabama flocked to the new country to try their fortunes. Since 1849, the mining of gold in Alabama has been somewhat desultory, though never entirely abandoned. During the past five years there has been a renewal of interest in the industry, and many new enterprises have been set on foot. Unfortunately, however, some of these were badly managed and have come to grief, and the impression has gone abroad that the mining of gold in Alabama will not pay.

Certainly, it will not pay in the manner in which the work has been carried on at many places, for most of the plants are arranged solely for the winning of free gold and are practically useless after the mining has gone down to the drainage level, and the ore is in its original condition of a sulphuret. Thus most of the mills have ceased work after the free milling surface ore has been exhausted. A few years ago Dr. William B. Phillips undertook for the Alabama Survey an examination of the gold region of the state, but this work was interrupted by unavoidable circumstances after he had spent only a few weeks in the field. His report, in Bulletin No. 3 of the Alabama Survey documents, showed conclusively that with proper methods, such as are in use at the Hailes mine in South Carolina and elsewhere and adapted to the successful working of sulphurets, the mining of gold could be made profitable in many places within the borders of this state. The examinations of the last season have only served to confirm this opinion of Dr. Phillips and to bring to light a number of new localities where the mining of gold with proper methods of extraction may surely be made profitable The gold does not seem to be distributed over the whole of our crystalline schists, but it is mainly confined to those belts of partially crystalline, argillaceous slates which have been named the Talladega formation by the Geological Survey A part of these slates are equivalent to the Ocoee group of Dr. Safford in Tennessee. This is the belt which lies furthest towards the northwest, making the northwest border of the crystalline schists, but there are two other well defined belts of almost exactly identical rocks crossing our crystalline area further to the southeast, and these belts also are rich in gold-bearing quartz veins. In one locality only, of those examined, the gold is found in a fully crystalline mica schist.

In most instances the gold is associated with veins of quartz which appear to be interbedded with the slates themselves, and in such cases the veins are usually not solid sheets of quartz but strings of lenticular masses of quartz wrapped in the slates, and occupying a width or thickness of strata of twenty or thirty feet. In other instances the quartz veins cut across the strata and are then only a few inches in thickness but very rich in gold. In the westernmost belt of these gold bearing rocks, the quartz vein is quite thin, only a few inches, but on the other hand of exceptional richness. For several years past the attention of capitalists has been directed to the gold fields of this and adjoining states, and it appears certain that with ordinary care and good judgment in the management the mining of gold will soon be numbered among the paying industries of Alabama.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE CENTIMETRE GRAMME SECOND AND THE CENTIMETRE DYNE SECOND SYSTEMS OF UNITS AND A NEW GRAVITATIONAL EXPERIMENT.

B. REGINALD A. FESSENDEN, ALLEGHENY, PA.

THE C. G. S. system of units was undoubtedly a great advance over previous systems, but it has at least one serious disadvantage. This is the employment of the gramme as one of the fundamental units. Mass is not a fundamental conception, and has no claim to be put in the same class as length and time. We can conceive of matter as distinct from mass just as easily as we can conceive of matter as distinct from electricity, and far more logically, for each unit of matter is always associated with the same quantity of electricity, while the amount of mass associated with the unit of matter, *i. e.*, the atom, is more than 200 times as great in the case of some kinds of atoms as in others.

There is, therefore, this theoretical objection. There is also a practical one. Any system of units must be logical, in that the dimensional formula for any quantity must be made up of such concepts only as are necessarily associated with that quantity. This is not the case with the C. G. S. system. The dimensional formula for quantity of electricity in the electrostatic system of units is $L^{\frac{3}{2}} T^{-1} M^{\frac{1}{2}}$, in which the conception of mass is brought in. Now, mass has no connection with electricity, so far as we know at present; if there were no such thing as mass we should still have electricity, and therefore the system of units which gives such a formula is defective.

There is a second practical reason. This is, that in the C. G. S. system of units it is much more difficult to see readily relations between different quantities, and to interpret them, than in a more theoretically perfect one, on account of the fact that the M in the formula of a force which has no necessary connection with matter may cancel out with an M which has a legitimate right to be there For instance, suppose that, in working out a problem, we get such a result as M/T, this may mean almost anything, *i. e.*, it may be the product of various things, and what these are is not readily apparent.

As a matter of convenience, the writer has used a system of units in which the dyne takes the place of the gramme, and has found that there is a considerable advantage.

In this system the unit of mass drops back into its rightful place, and is a dimension of the same sort as the unit of electricity or the unit of magnetism. Gravity is treated as a separate substance, distinct from matter, but residing in it in the same way as magnetism is supposed to reside in iron, and unit quantity of gravity is defined as that quantity which will attract equal quantity placed at unit distance with unit force. The atomic weight of an atom is its permeability to gravity, and corresponds to μ in magnetism. Lines of gravitational force are supposed to radiate from a body charged with gravity in the same way as from a body charged with electricity or magnetism.

Current of gravity is the quantity of gravity which passes between any two points in unit of time, and unit of gravitational potential causes unit current of mass through unit resistance.

To show the advantage of the C. D. S. system over the C. G. S. system, the following table is subjoined, which gives the principal dimensional formulæ in Electricity, Magnetism, Heat and Gravity in both systems:

C. D. S. Units.	Gravity.	Mag.	Elec. Stat.	Elec. Mag.	Heat.
Quantity	$\sqrt{FL}$	$\sqrt{FL}$	$\sqrt{FL}$	$\sqrt{FL^2/T^2}$	FL
Current	$\sqrt{FL/T}$	$\sqrt{FL/T}$	$\sqrt{FL/T}$	$\sqrt{FL^2/T^2}$	FL/T
Difference of Pot.	$\sqrt{F}$	$\sqrt{F}$	$\sqrt{F}$	$\sqrt{FT/L}$	1
Resistance	T/L	T/L	T/L	L/T	T/FL
Capacity	L	L	L	L^2/T^2	FL

C. G. S. Units.	Gravity.	Mag.	Elec. Stat.	Elec. Mag.	Heat.
Quantity . M	$\sqrt{L^3}\sqrt{M/T}$	$\sqrt{L^3}\sqrt{M/T}$	$\sqrt{L^3}\sqrt{M/T}$	$\sqrt{L}\sqrt{M}$	L^2M/T^2
Current . M/T	$\sqrt{L^3}\sqrt{M/T^3}$	$\sqrt{L^3}\sqrt{M/T^3}$	$\sqrt{L^3}\sqrt{M/T^3}$	$\sqrt{L}\sqrt{M/T}$	L^2M/T^3
Difference of Pot.	L^2/T^2	$\sqrt{L}\sqrt{M/T}$	$\sqrt{L}\sqrt{M/T}$	$\sqrt{L^2}\sqrt{M/T^2}$	1
Resistance	L^2/TM	T/L	T/L	L/T	T^2L^2M
Capacity	MT^2/L^2	L	L	L^2/T^2	L^2M/T^2

Incidentally, it may be noted that the notation is more concise. This, however, is merely an accidental point, the main thing being that the C. D. S. system is "ethically" more correct, and that it does not distort ideas so much in the handling as the C. G. S. system does.

It will be found convenient to denote the different quantities by means of subscript letters. Thus, R_g, R_m, R_{es}, R_{em}, R_h represent gravitational, magnetic, electrostatic, electromagnetic, and heat resistances. So, also, W_g represents gravitational work, *i.e.*, $1/2mv^2$, W_{em} represents electrical work, or C^2R, W_h represents heat energy, being really only a particular case of W_g, in which the algebraic sum of the vectors representing the velocities is zero, and W_m represents magnetic work, or $B \times M.M.F.$ One or two remarks may be made in regard to these formulæ. There has been some doubt in regard to the correct dimensional formula for temperature. This has been caused by the incorrect assumption that k, the specific heat of a body, is a number. That this is not the case follows from the law of Dulong and Petit. According to this, the atomic heat of all the elements is the same. Therefore, the heat required to raise a cubic centimetre of any substance one degree C., *i. e.*, its specific heat, is equal to the heat required to raise the temperature of a single atom the same amount $\times$ the number of atoms in the cube. This last is a number, and the former depends upon the kinetic energy of the atom. As the dimensional formula for kinetic energy is the same as that for work, *i. e.*, LF. (in the C. D. S. system), the formula for temperature must equal $FL \div FL$, *i. e.*, unity.

We obtain the same result by considering the fact that Quantity of Heat $\times$ Heat Potential must equal Work, *i. e.*, $LF \times$ heat potential $= LF$. A current of Heat, then, is a cur-

rent of energy, in the form of kinetic energy. Temperature is heat potential, and specific heat is heat capacity. It is evident, therefore, that, like the gramme, the calorie must vanish from a rational system of units, and its place be taken by the erg and joule. Unit heat flux is one erg per second. Unit difference of heat potential is one degree C. (Theoretically, it should be the temperature to which one erg will raise unit mass of unit matter, *i. e.*, unit mass of hydrogen.)

Unit specific heat will be possessed by a body which requires one erg to raise one cubic c. m. one degree C.

The consideration of the gravitational formulæ gives us some ideas in regard to gravity, and suggests some experiments which have as yet not been tried. The resistance of mass to motion, or inertia, varies directly as the acceleration, and as the mass. It is independent of place or the actual distance passed over in attaining the velocity. The energy possessed by a body in motion is proportioned to the integral of the various accelerations received by it, squared; *i. e.*, it varies as the velocity squared.

We have an exact analogy to this in the case of motion of matter in a frictionless fluid. Suppose a ball placed in a fluid, such as water, which we will suppose to be frictionless. Then, on moving the ball, we may conceive of a vacuum being formed behind the ball, and that this vacuum will be proportional to the square of the velocity with which we move the ball through the water. The water is, of course, supposed to have inertia, otherwise the vacuum would not form. So long as the velocity with which the ball is moving is constant, no work is done, and there is, therefore, no resistance to the motion, and it will continue in motion forever, unless opposed by some force. Suppose, however, that the ball meets with an obstacle which tends to stop it, then the vacuum will tend to close up, and the water will push the ball ahead, till an amount of work has thus been done equal to that done in making the vacuum originally. Such a behavior corresponds exactly with the behavior of matter moving in the ether.

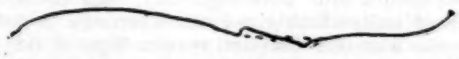
This theory, however, demands a reconception of the ether, for it is generally taken that the ether possesses no inertia. On closer examination, however, it will be seen that the difference is only apparent. In all the cases where we have had opportunity for measuring any inertia of the ether, a finite quantity only of the ether has been in motion. In the case of an electric circuit, for instance, the only ether in motion is that definite amount corresponding to the current produced. It is, of course, well known at the present time that electrical energy is not transmitted along the wire, but through the dielectric, but this does not affect the statement made that the only inertia effect which could be perceived would be that due to the motion of a definite amount of ether. Therefore, as no inertia effect has ever been found in connection with the motion of the ether in an electric circuit, we are justified in saying that the inertia of the ether is negligable in such a case. But we are not justified in saying that the inertia is negligable in the case where an infinite amount of ether is in motion, as would be the case, according to this theory, when a solid is moved through space, for an infinite amount of the infinitely small may be appreciable.

If, however, we take the two fluid theory of electricity, which, as Dr. Lodge has shown, is forced upon us by the consideration of many phenomena, and consider an electric current as the shearing past each other of two dissimilar parts, which together make up the ether, then there need be no such modification of our views, for, since in any case of electric flow there are always equal quantities of plus and minus electricity, and we may suppose the moments of inertia equal and opposite, no inertia effect could, of course, ever be observed in an electric circuit. When, however, the ether is moving as a whole, the inertia effects would be added instead of subtracted, and we would have, as shown above, all the phenomena of gravitational inertia.

It is, of course, not necessary for a body to have mass in order to display inertia effects, for its resistance to motion may be due to a "counter-motive" force, as in a circuit having self-induction; consequently there is no difficulty in accounting, in various ways, for the ether showing an inertia effect.

To take up the theory, for it is more than a mere imagining, having been worked out mathematically with some fullness in several directions; from Fizeau's experiment (confirmed by Michaelson and others), we know that when matter moves it drags with it a certain amount of the ether, but that a certain part remains behind, flowing through the matter. If this ether has any inertia (using the word in its broad sense), then there will be an effect similar to that which occurs when a sieve is moved through water. A vacuum, or a spot of less density, or of less rigidity will be formed behind the body. The size of this spot will vary as the velocity, and if the velocity is doubled the spot will be doubled, and four times as much work will be done in making it. And this no matter what the time in which the spot (which we will call the vacuum, provisionally) is formed, or where in space it is formed. On taking away the driving force the ether will close up on the body again, and push it on, till the vacuum exists no longer, and consequently all the work done in forming it is given up again. As the ether is supposed to have no friction, mere motion of the vacuum from one spot in space to another will necessitate no work, and consequently we have Newton's law, that a body tends to continue in its state, whether of moving with a given velocity, or at rest.

This is the part of the theory which deals with inertia, and the experiment referred to above is as follows: Set a body in motion, under the action of a constant force, then remove the force, and examine the body at the time when the force is removed. If the ether has inertia, then at the instant when the accelerating force is removed there will be an abnormal reduction in speed for an exceedingly small time. This will be followed by an abnormal acceleration, also acting for a very small time, and of such dimensions that after the lapse of a very small time, the velocity of the body will be the same as if neither the retardation nor the acceleration had existed. If the time during which these effects take place be not too small, it will be observable on a chronograph, and will give a trace as follows:



The dotted line shows the trace if the effect had not taken place, the other the trace if the effect does occur. It will be seen that they only differ for an exceedingly small portion of time, and it is doubtful if the experiment would succeed, even if the effect existed. It has, however, I believe, never been looked for.

If this be the true theory of inertia, then the theory of gravitation is as follows: If we take a rod of any solid substance, and press down one atom, which we will call A, it pulls down the atom next it, which we will call B, because, though the atom B is moving, it merely oscillates about a fixed point, and is always within reach of the influence of A. This property is what we call rigidity, and it is this which enables a solid to stand a shearing stress.

If the solid is melted it is called a fluid, and is commonly supposed to be unable to withstand a shearing stress. This is due to the following circumstance: Let us press down A. If B did not move, then B would have to follow A, if it were not that in a fluid the atoms no longer oscillate about a fixed point, but change their positions relatively to one another. The atom B moves at ordinary temperatures at a velocity of somewhere near 100,000 centimetres per second. The distance between any two atoms is somewhere in the neighborhood of 1/100,000,000th of a cm. Consequently in the 1/1,000,000,000,000,000th of a second, the atom B will have passed without the radius of attraction of A. Consequently we see that for any forces which are impressed in a greater time than 10^{-15} second, the fluid will have no rigidity. But if the force is applied in less time, we have no reason for supposing that the fluid will not resist shearing, or that a water tuning fork could not be constructed at the centre of the earth. For, if we accept the electrostatic theory of cohesion, the force which A exerts on B when A is pulled down travels at the rate of more than 10^{10} c. m. per second. As B will have to move say 10^{-8} c. m. to get out of the way of the pull from A, we see that if an impulse is given in less than 10^{-18}th of a second, B will be pulled down, and the fluid will resist a shear. And it is this force which acts to join the atoms together which gives rise to the phenomenon of surface tension. Consequently we see that if the ether has rigidity, whether it be a solid or a fluid, it must have surface tension.

Let us take the case of two bubbles of air in water. There is a surface tension at the junction of the air and water, and it may be shown that the effect of this is to bring the two bubbles together. A similar result would follow if the two bubbles had their places taken by two drops of water hotter than the rest of the water. Or if the drops were made up of a number of concentric shells, the density of each shell being greater than that of the shell next inside it, the equivalent of such a shell would be produced by sticking the prongs of two tuning forks into the water, for at those places where the velocity of a prong was greatest the density of the water in unit volume would be least, and the forks would be attracted. So if we suppose the atom to be, say, a Thomson vortex ring, and that this vortex ring, in virtue of its rotation, renders the ether next it less dense, or less rigid, it would attract any other atom similarly constituted in the same manner as we know two atoms do. And this attraction would be always the same in quantity, no matter what the temperature or surroundings, so long as the atom was the same, *i. e.*, its weight would be constant. And if another atom produced a different degree of density or rigidity near it, its weight would be different and constant.

Thus we see that if the ether has inertia (or some "counter motive force" opposes its motion), then matter must have inertia, and if the ether has rigidity, and atoms produce a difference in the cohesion of the ether near them, then all atoms will attract each other in proportion to the change they produce in the rigidity of the ether near them.

There are two experiments which seem at first sight to contradict Fizeau's experiment. First, the fact that a rotating disc of matter has no effect on a magnetic needle placed at its centre. Second, the fact that light suffers no retardation or acceleration when passed along the lines of force between two plates at different potentials, and placed in an electrolytic bath.

The first is readily explained when we consider that when the disc is rotating it is carrying with it ether as a whole, *i. e.*, equal quantities of positive and negative electricities, or is equivalent to two currents of equal strength flowing in opposite directions, and consequently can produce no effect outside of the body. Or, to use Prof. J. J. Thomson's symbolism, the ends of the Faraday lines are both within the body, and do not pass outside, whereas in Professor Rowland's experiment the Faraday lines have one terminal on the disc, and the other outside. The two cases are not similar.

The second case, that of the electrolytic bath. In this the ether does not move as a whole, there is merely a shearing of plus and minus electricities past each other, and the algebraic sum of the velocities of the components of the ether is therefore zero. Or, the ether does not move, so far as any possible effect on light is concerned.

THE "GLACIAL PERIOD" PROVED AS A NECESSARY CONSEQUENCE OF THE EARTH'S MOVEMENTS.

BY MAJOR GENERAL J. C. COWELL, WINDSOR CASTLE, ENGLAND.

From the increasing interest that is manifested in all that relates to the glacial period, and the discovery, by General Drayson, of the Second Rotation of the Earth, it will be of value to those who are studying the geological evidences of the ice ages, to devote some time to the ascertained facts proving the Second Rotation as compared with the accepted theories, since these appear to supply all the conditions necessary for the explanation of the glacial phenomena, at regular intervals; and it is with the object of rendering the subject clear to them that the following remarks are offered to the readers of *Science*.

It has hitherto been stated by Herschel and other writers of his day, that the movement of the Earth, which caused the precession of the equinoxes and solstices, and the changes in Polar distance, and Right Ascension of the Stars, is "a conical movement of the Earth's axis round the pole of the Pole of the Ecliptic as a centre."

Drayson claims that this definition is vague, if not misleading, even as regards that part which speaks of a conical movement of the axis. He claims that it is the two half axes that trace cones, the apex of these cones being at the centre of gravity of the Earth.

He also claims that this conical movement of the two half axes is the mere mechanical result of a Second Rotation of the Earth, just as the conical motion every twenty-four hours, of all lines from the Earth's centre to points at the Earth's surface, is the result of the daily rotation of the Earth.

An examination of the annual changes in Right Ascension of every Star in the Heavens (see pages 163 to 219 in "Untrodden Ground in Astronomy and Geology") proves that a second rotation is the *only* movement which will explain the recorded changes in the Right Ascension of Stars. Hence, instead of some vague and undefined movement of the Earth occurring whilst the axis has what has been called "a conical motion," the detail movements of each point on the Earth's surface are accurately defined by the second rotation. Secondly, the Earth's axis traces *a circle* round the Pole of the Ecliptic *as a centre*, keeping constantly at the same distance of 23° 28′ from it, wrote Herschel and others.

In the face of the fact that the obliquity (*i. e.*, the angular distance between these poles) decreases about 47″ per century, the above statement is obviously erroneous.

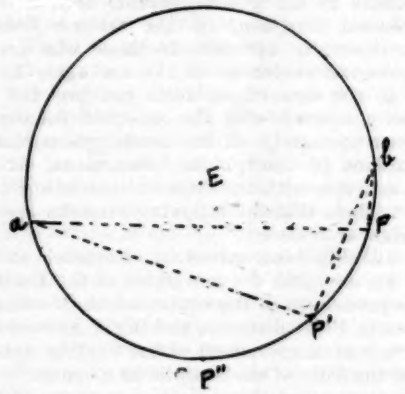
As an escape from this error it has been asserted by some that the Pole of the Heavens moves about 20″ annually at right angles to the arc joining the Pole of the Heavens with the Pole of the Ecliptic, but as the latter

Pole was supposed to move it was imagined that the course of the Pole of the Heavens was not a true circle.

Now, as it has been proved that the movement of the earth which causes the Pole of the Heavens to move, is a second rotation, it follows, as a geometrical law, that, as long as the Pole of this second rotation remains fixed, the course of the Pole of the Heavens must trace a circle, and no other curve than that of a circle. It has also been asserted that the Pole of the Heavens does trace a circle in the Heavens, but not round the Pole of the Ecliptic as a centre, this centre being *somewhere* very close to the Pole of the Ecliptic, but the exact position of this centre was unknown.

Hence, it is evident that the true curve traced by the Pole of the Heavens, or the true radius of the circle traced by the Pole of the Heavens has, during the past three hundred years, been undefined and unknown.

The confusion in one branch of astronomy which has prevailed in consequence will become evident by an examination of the following diagram:



E is the centre of the circle of which bPa is the circumference, b, P and a being three points on the circumference.

Suppose the angle bPa to be 95°. If the point P be moved to P′ then it is a geometrical law that the angle bP′a will also be 95°. Also if the point P be moved to P″ then bP″a will be 95°.

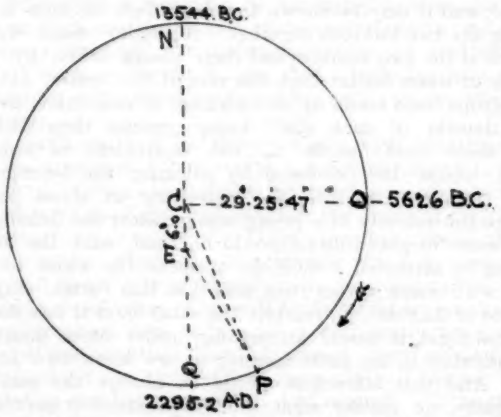
We can now apply this law to Astronomy. Suppose A and B to be two stars, and P the Pole of the Heavens, at any date, the stars being believed to be on the circumference of the circle traced by the Pole. Suppose the stars A and B to differ in Right Ascension exactly 95°. Then, as the Pole moved round the circumference to P′, the two stars A and B would always differ 95° in Right Ascension.

If repeated observations showed that the difference in Right Ascension between the stars A and B did not remain constant at 95°, but varied slightly from year to year, then these stars would be assigned "*a proper motion*" *in Right Ascension*, whereas the real cause of the difference in Right Ascension of these two stars, not being a constant quantity, may be due to the fact that the radius of the circle which the Pole describes is not that which it has been imagined to describe, and the two stars were not, in consequence, on the circumference of the circle. Some stars, on the other hand, are known to have a proper motion. During very many years it was asserted that the Pole of the Heavens traced a circle round the Pole of the Ecliptic *as a centre*, and on this erroneous assumption the theory of the proper motions of the stars was based. (See pages 126 to 130 in "Untrodden Ground in Astronomy and Geology.") Many earnest, hard-working men have employed their time in making out lists of the supposed proper motions of stars, and pages of astronomical societies' volumes have been filled with these lists. Medals have been given for this work, but what is their value?

To assert that any star has a "proper motion" in Right Ascension, in consequence of the Right Ascension varying, whilst the true course which the Pole of the Heavens traces has been unknown; and the exact manner in which each zenith is affected, has not even been considered yet, is very remarkable. But during the last hundred years astronomers have copied each others' proceedings, without apparently perceiving that to define the true circle traced by the Pole of the Heavens was the first important problem to be solved; and until this problem was solved any assertions relative to the proper motion of the stars were valueless.

Instead of the Pole of the Heavens tracing a circle round the Pole of the Ecliptic as a centre, and keeping constantly 23° 28′ from it, recorded observations prove that the Pole is carried by the Second Rotation round a circle, the radius of which is 29° 25′ 47″, the whole circle being completed in a period of 31,682 years, the Pole of Second Rotation being 6° from the Pole of the Ecliptic, and so situated that at the date 2295.2 A.D. the Pole of the Heavens, the Pole of the Ecliptic, and the Pole of Second Rotation will be on the same great circle of the sphere.

The following diagram indicates the course of the Pole of the Heavens during one entire Second Rotation of the earth:



The circle represents the course traced by the Pole of the Heavens, in consequence of the Second Rotation. At the date 13544 B.C. the Pole was at N, at 5626 B. C. it was at O, and at 2295.2 it will be at Q.

The distance of the Pole of the Heavens as it moves round this circle from C, the Pole of Second Rotation, is a constant quantity, viz.: 29° 25′ 47″. E, the Pole of the Ecliptic, is 6° from C. Hence, when the Pole of the Heavens was at N, it was distant from E 29° 25′ 47″ + 6° = 35° 25′ 47″.

The rate of the Second Rotation, as indicated by the length of arc over which the Pole is carried in a given time, is 40.9″ annually. Hence, we can easily calculate at what part of the circle the Pole was, or will be at, for any date. For example, at what date was the Pole at a point in the circle 90° from Q? 90° = 324000″, and these seconds divided by 40.9″ gives 7,921 years from the date 2295 A. D., that is, 5626 B. C. We now have an important triangle to deal with, viz.: the triangle ECP. We have EC = 6° (a constant) and CP = 29° 25′ 47″, another constant; when, then, we find the value of the angle

ECP (+2295–date in number of years) ×40.9″=the angle ECP at date given, we can calculate the value of the side PE, which is the distance of the Pole of the Heavens from the Pole of the Ecliptic, and is consequently the measure of the obliquity, and of the Arctic Circles, and Tropics on Earth at the date when the Pole was at P.

The method of calculating the distance PE, which is the value of the Obliquity, is very simple, and is given in detail at page 74 in "Untrodden Ground of Astronomy and Geology" (two sides and the included angle). By this calculation the Obliquity for the 1st of January, 1800, is found to be 23° 27′ 55.3″, and for the 1st January, 1850, 23° 27′ 30.9″, showing a difference of 24.4″ for fifty years during the first half of the present century. But, between 1800 and 1900, calculation gives a difference of 46.5″ (see page 75 of the same work). In Article 640 of "Outlines of Astronomy," by Herschel, is the following: "Meanwhile, there is no doubt that the plane of the Ecliptic does actually vary by the action of the Planets; the amount of this variation is about 48″ per century." This statement shows how entirely the true cause of the decrease of the obliquity was overlooked. It was positively stated that the Pole of the Heavens kept a constant distance of 23° 28′ from the Pole of the Ecliptic. If it did keep at this constant distance, then no amount of change, even of many degrees, *in the plane of the Ecliptic*, would produce even 1″ change in the obliquity, which would always remain 23° 28′.

That the Polar distance of a star can be calculated for 100 years or more, and from one observation only, is proved by numerous examples given from page 52 to 63 in "Untrodden Ground in Astronomy and Geology."

An examination of the last diagram given in this paper shows that the course of the Pole of the Heavens during one Second Rotation caused it to vary its distance from the Pole of the Ecliptic as much as 12°, and hence at the date 13544 B. C. the Arctic Circle and Tropics extended 12° more than at present, thus causing those vast changes referred to by geologists as "the Glacial Period," and giving the dates for the commencement, duration and termination of this period, which agree with the latest discoveries of geologists.

The Second Rotation gives accuracy of detail and a complete explanation of recorded facts, whilst by its aid calculations can be made which have hitherto been considered impossible. "A Conical Movement of the Earth's Axis round the Pole of the Ecleptic, as a centre, omits *all* details, and leaves recorded facts without any clear explanation. First, then, we have for a "conical movement of the earsh's axis" a second rotation of the earth, which *causes* a conical motion of the two half axes, and shows how the zenith of each locality on earth is affected by this movement. Second, for the Pole of the Heavens tracing a circle round the Pole of the Ecliptic as a centre, at a constant distance of 23° 28′, we have this centre 6° from the Pole of the Ecliptic, and 29° 25′ 47″ from the Pole of the Heavens, with the results explained above.

The following are some of the errors which have been, and still are, promulgated in consequence of the true movements of the earth being misunderstood by many persons :

First: On many celestial globes and star maps a circle is drawn round the Pole of the Ecliptic *as a centre*, and on these, near the circle, is written, "Circle described by the Pole of the Celestial Sphere in 25,868 years." This error is due to two oversights. First, although it was admitted that the two Poles decreased their distance from each other about 47″ per century at the present time, and had decreased their distance during all time of which we have any records, yet they always kept 23° 28′ apart. The second error was that, because the annual amount of the precession (about 1800 A. D.) was 50.1″, this rate was constant for all time, whereas, for a uniform movement of the Pole, the annual amount of the precession varied *with the distance apart of the two Poles.*

Second: It having been assumed by theorists that the Plane of the Ecliptic could not vary from a mean position more than 1° 21′, it has been asserted that the Obliquity could not vary more than 1° 21′. This error was promulgated in consequence of the true circle traced by the Pole of the Heavens not having been known. No matter how much *the plane* of the Ecliptic varied from a mean position, there could be no variation in the Obliquity, if the Pole of the Heavens was, as asserted, kept always 23° 28′ from the Pole of the Ecliptic.

The cause of the decrease in the Obliquity of *about* 47″ per century, its present rate, is not due to any change in the plane of the Ecliptic, but is due to the fact that the centre of the circle which the Pole describes is 6° from the Pole of the Ecliptic, instead of being coincident with it.

Third: It has been asserted that because the decrease in the Obliquity, or angular distance, between the two Poles was about 48″ per century, therefore in 10,000 years the decrease would be 4,800″=1° 20′ only.

Such a statement indicates a want of knowledge as to the *cause* of the decrease, and a forgetfulness of the geometrical law that a curve cannot decrease its distance from a point at a uniform rate.

An examination of the last diagram shows that a variation of 12° will occur in about 15000.

Fourth: It has been asserted that the Arctic Climate, which reached to about 54° Latitude during the Glacial Period cannot possibly be accounted for by astronomy. Because, "There is none amongst the slight variations of the Earth's movements which, even with the aid of any extension of time, however indefinitely great, could alter the present angle of the Earth's axis as it lies to the plane of the Earth's orbit. This angle, which is about 23°, is firmly fixed by that apparently essential property of matter—Inertia." It is singular that such a statement shou'd have been made, for the Earth's axis is not inclined to its orbit at about 23°, but at about 66° 33′, and it varies this angle at about 47″ per century at the present rate of the Earth's gyration, so it cannot be firmly fixed.

Fifth: The changes produced on various meridians and zeniths by the Second Rotation, are most important, but, notwithstanding this, have been hitherto entirely overlooked. In every observatory the Polar distance of a star is deduced from its observed meridian zenith distance, and its Right Ascension from its Meridian Transit. But, that the zeniths and meridians of two localities, differing in latitude, were differently affected by the so-called "conical motion of the axis," has been entirely disregarded.

Sixth: The standard measure of time is also affected by the Second Rotation, and a siderial day is at present a vague quantity, only imperfectly defined by the statement that it is the interval which elapses between two successive transits of the same star ; because this interval varies for nearly every star. *The only uniform standard of time* is the interval between two successive transits of the Pole of Second Rotation (see chapter 13 in "Untrodden Ground in Astronomy and Geology"). The statement made by Sir John Herschel in a foot note at the end of "Outlines of Astronomy" "that 3m. 3.68s. of purely imaginary time was inserted between 1833 and 1834 in order to correct

errors, and that the whole subject of time had fallen into confusion," is the result of an incorrect standard of time having been used, and still being used.

Seventh: By the present accepted *theories*, it is not known whether the annual rate of decrease in the obliquity (which is the same thing as a decrease in the distance of the Pole of the Heavens from the Pole of the Ecliptic) has a decreasing or increasing rate. It is now, and has been during many years taken as a constant quantity of 0.476″ annually, which is geometrically as unsound, as though it were stated that the Polar distance of a star decreased each year at a uniform rate. It is not known how long this decrease in the obliquity will continue, or when it will become an increase. It has continued during 1800 years at least, but when it commenced is not known. What the obliquity was 5,000 years ago, and what it will be 5,000 years hence, is not known; because the true course traced by the Pole of the Heavens relative to the Pole of the Ecliptic has not been known.

The Second Rotation supplies all these details, and proves their accuracy, by the agreement of calculation with recorded observations. The detail movements of every zenith are given by the Second Rotation, whereas hitherto all zeniths seem to have been imagined to be similarly affected by the so-called "Conical Motion of the Earth's axis." It is impossible to conceive more convincing proof of the truth of Drayson's discovery. The Second Rotation of the Earth merely gives accuracy of detail where hitherto there has been vagueness and imperfect definition.

The various statements that have been confidently put forward regarding the impossibility of any great change having occurred in the Arctic Circles and Tropics, is due to the fact that the true course of the Pole of the Heavens relative to the Pole of the Ecliptic has hitherto been unknown. Such statements, however, having been accepted as if they were statements of fact, without full enquiry, have induced some writers to put forward extraordinary theories incapable of being proved, to account for an Arctic climate having descended to about 54° latitude within comparatively modern times.

Considering that the true course of the Pole had never been accurately defined until the Second Rotation was made known, it appears strange that so many forms of vague speculation should be seriously discussed as a possible cause of the glacial epoch, whilst the fact that the centre of the circle which the Pole describes is proved to be 6° from the Pole of the Ecliptic, has been overlooked, or considered quite impossible.

More especially is this neglect remarkable because twenty-five years ago the dates for the duration and termination of the Glacial Period were accurately given by Drayson in consequence of a knowledge of this beautiful movement, and when scarcely a geologist believed that the dates were anything but erroneous; and now what do we see? Geologists substantiating by evidences which none can doubt, the absolute accuracy of his observations and calculations.

It is to be expected, after such results, that astronomers will define, in unmistakable terms, the true course of the Pole of the Heavens relative to the Pole of the Ecliptic. The definitions of the past will not and cannot satisfy, and a consideration of the following questions ought not to be beneath the notice of any one, because until the matter is solved conclusions as to the proper motion of stars, the changes of latitude of observatories, and even the variation in eccentricity of the Earth's orbit, are assumptions only, based upon unsound foundations.

1. Is the true course of the Pole a circle round the Pole of the Ecliptic as a centre, keeping constantly at 23° 28′ from it as stated by Herschel and other writers?

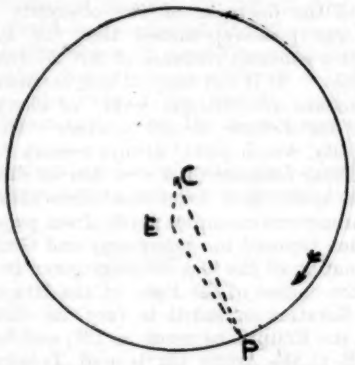
2. Is it an irregular curve always moving at right angles to the arc joining the Pole of the Heavens to a movable Pole of the Ecliptic?

3. Or, is it a circle round an undefined point, which is supposed to be the mean position of a movable Pole of the Ecliptic? If so, where is the point?

It is probable that the facts of the Second Rotation have not been carefully examined, as it appears that some individuals hold the opinion that it is merely a vague theory opposed to well established facts in astronomy. The very reverse is, however, really the case, and the following are some amongst many problems which can be solved by a knowledge of the Second Rotation of the Earth.

Such problems cannot be solved by those persons who are unacquainted with it.

Problem 1.—Calculate the mean obliquity of the Ecliptic for any date, say the 1st of January, 1873, without reference to the observed obliquity at any previous date, and without reference to the annual rate of decrease found by observation.



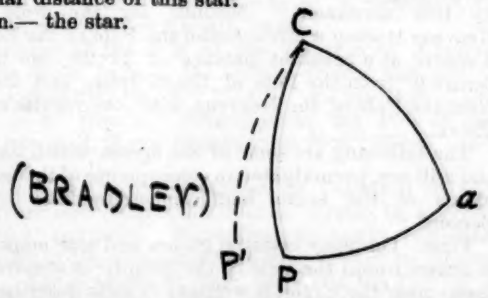
Where EC=6°–CP=29° 25′ 47″, and the angle ECP for date 1st January, 1873, is found thus:

(2295.2–1873)×40.9″=4° 47′ 47.9″ = angle ECP on the 1st January, 1873.

On calculating the value of the side PE, which is the obliquity, this value is found to be 23° 27′ 20.2″, and it is recorded in the Nautical Almanac, 1873=23° 27′ 20.88″.

Problem 2.—In Bradley's catalogue of stars for 1st January, 1755, the mean north Polar distance of Alpha Draconis was given as 24° 26′ 47.4″. This star is 26° 37′ 3″ from C, the pole of Second Rotation. Calculate the mean North Polar distance of this star for any other date, say 1st January, 1850, and 1st January, 1890, without any reference to the annual rate of variation in North Polar distance of this star.

Solution.— the star.



From a knowledge of the Second Rotation:

The side PC=29° 25′ 47″.

The side Ca=26° 37′ 3″.

From Bradley's Record Pa=24° 26′ 47.4″ on the 1st January, 1755.

Having the three sides of the spherical triangle i Ca, the angle at C can be calculated, and it proves to be 53° 15′ 26″ for the 1st January, 1755.

Owing to the Second Rotation the Pole P is carried round C as a centre, at the annual rate of 40.9″. Between 1755 and 1850 there are 95 years, which multiplied by 40.9″=1° 4′ 45.5″ for the increase of the angle at C, which becomes 54° 20′ 11.5″ for 1850, when the Pole has reached P′.

We then have P′C=29° 25′ 47″ Ca=26° 37′ 3″ and the included angle P′Ca=54° 20′ 11.5″ to calculate P′a.

By calculation P′a=24° 54′ 21.2″ and found by observation, 24° 54′ 21.4″.

For 1st January, 1890, the angle C becomes 54° 47′ 27.5″ and by calculation, as before, P′a=25° 5′ 55″, and by the Nautical Almanac 1890, 1 January=25° 5′ 54.8″.

Hence the polar distance can be calculated for 135 years to within one second; and, considering the uncertainty of refraction, it is probable that the calculation is more correct than observation.

Such a result speaks for itself, and may well excite admiration of General Drayson's perseverance during many years of tedious calculation, until his labors have at last been rewarded by the splendid discovery of the radius of the circle described by the Pole of the Heavens, and the centre of that circle.

Had Newton with his marvellous intellect known, as we do *now*, that an almost tropical climate existed in what are now Arctic regions, and an Arctic one as low as 54° of latitude; that the axis of the earth varied its inclination to the plane of the Ecliptic; and that vast elevations and depressions had occurred upon the surface of the Globe causing its centre of gravity to vary its position by the consequences of these movements, as in transferring enormous quantities of the waters of the sea from one locality to another; who can doubt that he would have discovered the manner in which the Pole of the Heavens would have moved in obedience to the law of gyration? And with such catalogues as we now possess, he might have achieved the same results as have been obtained by Drayson in discovering, as he has done, the details of the Second Rotation. At all events he would certainly have attributed the Precession of the Equinoxes to the true cause of this, and not to the assumed joint action of the sun and moon on the protuberant Equatorial Zone.

A SEGREGATION OF FRESH-WATER FISHES.

BY THEODORE GILL, M. D., PH. D., WASHINGTON, D. C.

One of the most remarkable facts in zoögeography is the segregation of the greater part of fresh-water fishes represented by the ostariophysal orders, that is, the families *Characinidæ, Cyprinidæ, Siluridæ* and their subdivisions. These are all genetically related, and must have developed from a common stock early accommodated to the fresh water and subsequently differentiated into many families and a host of genera with many hundreds of species. The few marine representatives of that host are the *Ariinæ*, or *Tachisurinæ*, and the *Plotosidæ*, and these must have diverged from primitive fresh-water types.

Another case of segregation of a widely distinct series of families has never been recognized, and attention should be directed to it. It is that of the haplomous fishes.

The *Haplomi* are teleocephalous fishes with a pneumatic duct and abdominal ventrals, and were considered by Prof. Cope to be an order of physostomous fishes, including *Esocidæ, Umbridæ, Cyprinodontidæ* and *Hypsæidæ*. These are evidently related to each other, although not very closely, and are mostly fresh-water forms. There are two other families which have hitherto found no satisfactory resting place which I am disposed to associate with the typical haplomes—*Percopsidæ* and *Aphredoderidæ*.

If the six families thus associated are really genetically related, we would have another series of families segregated as a fresh-water group, and which must have been long established. The only one of these six families with marine representatives is *Cypronodontidæ*, and this seems to be the most generalized and most nearly related to the Synentognathous fishes, on one hand, and the Perciform, on the other. Whether the salt-water Cyprinodontids are the descendents of primitive salt-water fishes or have reverted to the sea in later times, is now an open question. This I do not propose to discuss at present, reserving it for future consideration, as well as numerous collateral questions which may suggest themselves. My only object at present is to draw attention to the zoögeographical fact mentioned and the morphological problem involved.

It is noteworthy that all the families enumerated are represented in the United States, and half of them (*Hypæidæ*, or *Amblyopsidæ*, *Percopidæ* and *Aphredoderidæ*) are found nowhere else. The *Esocidæ* and *Umbridæ* are represented in Europe as well as America. The *Cyprinodontidæ*, or *Poeciliidæ*, are generally distributed. All the families are remarkably well defined. Finally, it may be suggested that the unwonted position of the anus (jugular or thoracic) of two (*Amblyopsidæ* and *Aphredoderidæ*) is possibly more than a mere coincidence, and may be an inheritance from common ancestors.

BIOLOGICAL INVESTIGATION IN BOTANY.

BY J. CHRISTIAN BAY, BACTERIOLOGIST OF THE IOWA STATE BOARD OF HEALTH, AMES, IOWA.

A couple of smaller notes on the biological question, as far as botany is concerned, were published by me in this journal. To the first of these, What is biology? this little note is to be regarded as an appendix. My first paper contained, originally, a number of notes on the modern methods of biological investigation in botany; I kept them back in order that they should not be misunderstood.

A short time ago I received Professor N. Wille's inauguration speech in taking the chair of botany at Christiania, Norway. Professor Wille has said, in a few words, what I wished to say on the occasion above referred to. Therefore, I shall quote him:

"The so-called plant-biology is a child of the Darwinian theory of selection. It should be called, more correctly, *oecology*. This branch of investigation should embrace, as nearly as possible, the science of all life-phenomena of plants, *minus* physiology: in other words, oecology is the science of the mutual relationship between the plant and the surrounding nature, when this relationship does not rest upon physical and chemical causes.

"Oecology has still retained many reminiscences from the teleological conception of earlier days, when nature as a whole was thought of as created for the sake of being principally of use to, or a plaything for, the human race. Plant oecologists, or as they like to call themselves, plant biologists, have the idea that everything must be useful or developed in a certain way in order to be of use for certain purposes.

"We shall give an example of one of the typical representatives of this line of study. He placed an ant on the leaf of *Sonchus*, and found that the ant tore the cuticula, so that the milk juice from the leaf came out. The resin

of this juice stuck to the ant, which became so affected by it that it rolled down from the leaf. The conclusion drawn from this experiment was that milk juice is, wherever it is found, protective against ants, and keeps them away from the plants.

"It is easily understood that it is unallowable to draw such general conclusions from facts so uncertain and which prove so little. Before such a conclusion could be drawn, we ought to find answers to the following questions:

"1. Are the ants kept away from the plant by the milk juice?

"2. How much damage would the ants make, and how would they eventually make it?

"3. Is this damage so extensive that it would be in proportion to the energy used in producing the milk juice?

"4. Is the milk juice produced for a certain purpose, or is it only an inevitable by-product of metabolism?

"5. Does the milk juice of Sonchus serve for other purposes?

"6. Is the milk juice not serving for different purposes in the different plants?

"To give an answer to these questions would take years of study; therefore, it is easier to draw conclusions from the observations made in a few minutes, by means of imagination. The importance of imagination to the investigator is not to be underestimated, but critical consideration must separate out the chaff. However, it occurs to me that he who looks round, at present, in the science of plant biology, will find more chaff than grains."

This is another reason why biology should not replace physiology. It is pleasing to know that excellent biological theories have been established by Darwin, Bütschli, Schimper, Schwendener, Haberlandt, Mueller, Moeller, Lundström, Warming, Delpino and many others, and the most important facts put on record by such men as Trelease, Robertson, and many Europeans; but outside of flower-biology a great deal of the work done—especially when the facts have been arranged in order to prove a theory made beforehand—cannot stand close inspection.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

THE IMAGINARY RACE OF CANSTADT OR NEANDERTHAL.

Dr. D. G. BRINTON, in his "Current Notes on Anthropology"—XXII (*Science*, Feb. 10, 1893), has given a brief summary of what has been said about the skulls of Canstadt and Neanderthal at the twenty-third meeting of the German Anthropological Association at Ulm (August, 1892). According to this summary, many facts allied by von Holder, Virchow, Kollman and Fraas, show that the skull of Canstadt, in all probability, belongs to the fourth or fifth century, A.D., and that the Neanderthal skull is hardly more ancient. In short, the human race of the quaternary period, described by de Quatrefages and Hamy, has never existed,—it is an "imaginary race," and "it should be recognized, once for all, that there is no sort of foundation for these scientific dreams."

Mr. Henry W. Haynes has answered to two points of Dr. Brinton's article (*Science*, Feb. 24, 1893). This answer was followed by Dr. Brinton's reply (*Science*, March 10, 1893). Finally, Mr. E. W. Claypole (*Science*, April 7, 1893) has sent a short note in answer to Dr. Brinton.

In their answers, Mr. Henry W. Haynes and Mr. E. W. Claypole have discussed the historical aspect of the question, but the main point has not been handled. This will be my aim.

According to the explanations given in 1867, 1872 and 1892, by Dr. von Holder, Dr. Fraas of Stuttgard, and Virchow, it is stated that the Canstadt skull has no date.

Be it so, I do not object.

According to the statements of the same German anthropologists, Dr. Fullroth's relation concerning the skulls of Neanderthal discovery is false, and it is by no means demonstrated that this celebrated skull is a fossil one, but, on the contrary, it has probably belonged to a Frank.

Be it so, if you like; I can agree with it.

But I cannot agree with Dr. von Holder concluding: "Die Rasse von Canstadt ist also meiner Ansicht nach ein Phantasiegebilde wenn ich so sagen darf, in vielleicht eben so hohen Maasse wie die schönen Gedanken es sind, die über den Neanderthaler Fund in die Oeffentlichkeit gedrungen sind"—and I must protest against Dr. Fraas's like conclusions: "Wir dürfen füglich die Cannstatter Rasse für immer zur Ruhe legen, und hoffen dass sie nicht mehr auferstehe, die Geister zu beunruhigen."

I may forsake to the anthropologists of the Congress at Ulm the skull of Canstadt, and, perhaps, the skull of Neanderthal; but the fossil human race of Europe—which we are speaking about—has not been established *over those two documents only*. There are, further, the fossil bones or skulls of Staegenaes (Sweden); of La Denise (France); of L'Olmo (Italy); of Eguisheim (Germany); of Clichy (France); of Brüx (Bohemia); of Schipka (Moravia); of Tilbury docks (London); of Arcy (France); of Gourdan (France); of Malarmand (France); of Goyet (Belgium); of La Naulette (Belgium); of Spy (Belgium).

The Congress of Ulm has forgotten all those, and discussed the skulls of Canstadt and Neanderthal only, *as if the fossil race of our ancient European ancestors were personified in these two skulls.*

People certainly know that de Quatrefages and Hamy have given to every one of the pre-historic races they established a name recalling the most ancient or the most celebrated locality where were found human remains reported to one of those types. The names "race of Canstadt," "race of Cro-Magnon," "race of Furfooz," have no other meaning for those anthropologists, and must not have any other signification for ourselves

Logically, therefore, M. Virchow, von Holder and Fraas could only conclude "that de Quatrefages and Hamy had been unlucky by choosing precisely Neanderthal and Canstadt in order to christen that race." They could affirm nothing more.

Before being empowered to conclude that there is no fossil human race presenting the type of the Canstadt's or Neanderthal's skull, they ought to have examined every other discovery and demonstrated that those discoveries were of no more value than the one of Canstadt or Neanderthal. Then only they could rightly call that race a "Phantasiegebilde." But they did not.

I do not wish to examine by myself every one of the discoveries I have quoted, and to discuss their value. I will only examine the human remains of Spy—having been an actor by their discovery and author of their description. For seven years I have been now busy with the study of these remains.

One of the discoverers, Professor Max Lohest, will show in a forthcoming issue of *Science* the geological value of the human remains found at Spy; and I myself will endeavor, in my following letters, to show the anthropological signification of those remains.

American readers will then be able to decide if this ancient race, established by de Quatrefages and Hamy, is an "imaginary" one and a "Phantasiegebilde" or not.

JULIEN FRAIPONT.

Liege, Belgium, Dec. 1, 1893.

Molothrus Ater and His Hostesses.

Noticing the article by Charles W. Hargitt, Ph. D., in *Science* for Dec. 1, in regard to the cowbird, I am prompted to relate my experience, since what seems to be with him a rare occurrence, is, in my locality at least, a very common one. I refer to the appropriation of the chipping sparrow's nest by this parasite as a receptacle for its eggs.

It has been my experience with the chipping sparrow, as it has Mr. Hargitt's, that it is exceedingly sensitive about having its nest disturbed, and will desert it upon the least provocation, even though the full complement of eggs may have been deposited. It has seemed to me sometimes that merely a sudden discovery of the nest, with the bird upon it, was all the ground the bird needed as a cause for a hasty removal from those parts, even though not a twig or portion of the tree or bush be touched. This I have particularly noticed, and as I have been making this species a special study the past Summer, I have had occasion to note many times the exceeding sensitiveness of the bird in this regard.

But much as *Spizella socialis* dislikes to have her nest disturbed, my observations have been to the effect that her likes and dislikes are not at all regarded by the cowbird. The evidence which my observations have produced along this line is quite to the contrary of that which Mr. Hargitt's observations find. I well remember that the first egg of the cowbird ever found by myself, in those days of fond recollections when I first began the delightful pursuit now so dear to me, rested snugly in a nest of the chipping sparrow. Since that time I have never dreamed of this being a rare occurrence, for I have so found them times without number; and in several instances have known the hostess so imposed upon, contrary to her exceeding wariness of being disturbed, to accept the situation forced upon her and rear the alien vagabond. I have also found that, in cases where the cowbird found *Spizella's* nest to contain but one egg of its owner, it will sometimes deposit more than one of its own; in one case, I found three. In such instances, the chipping sparrow, of course, does not accept the situation,—the *sit*-uation is doubtless too large for such a small bird to accept. I can only say in conclusion of this part of my subject that my observations lead me in quite the opposite direction from Mr. Hargitt's conclusion, for I certainly have found *Spizella socialis* a very commonly imposed-upon hostess of the cowbird.

I have at different times found eggs of *Molothrus* in what seemed to me to be out-of-the-way places for them. Among these "out-of-the-way places" I would mention the nests of the meadowlark, robin and kingbird, for I have found them there, and apparently no attempts had been made to remove them from the nest, for in the cases of the meadowlark and kingbird they were equally advanced in incubation with the rightful occupants.

And now, if I may be pardoned for deviating somewhat from my subject, and since the chipping sparrow's sensitive nature is before us for consideration, I would like to ask for enlightenment from more experienced heads than mine in regard to a matter that has puzzled me. The past summer I found a nest of the chipping sparrow containing four eggs. Meaning to test the bird's sensitive nature in this case, I did not so much as touch any portion of the evergreen tree containing the nest, but hastily removed from the locality. Returning two days later to learn if, perchance, the bird had deigned to still occupy her well-hidden home, I found that in place of the four eggs only two remained. Returning again the next day, I found but one egg in the nest, and coming again the following day, I found an empty nest. The eggs must have been removed from the nest without being broken, for not a trace of an egg-shell was anywhere about.

This in and of itself would not necessarily be a very remarkable occurrence, but this is only one instance. I have several times observed the same things in cases where a nest of the chipping sparrow had been discovered containing eggs.

Can the editor of *Science* or any of its readers offer a solution of this problem? I should be interested to hear.

The chipping sparrow is well worthy the study of everyone. Many excellent traits of character will be discovered.

Neil F. Posson.
Batavia, N. Y.

Protection of Birds from the Boys.

In *Science*, Nov. 10, Dr. Shufeldt charges the "small boys" with being the most destructive of all the agencies that are operating to exterminate our beautiful and useful birds. Teachers in urban schools who conscientiously study the daily conduct of their pupils and inquire of them as to their daily associations know that the Doctor's statements are sadly near the truth. The accusation would better be made without limitation in the size of the boys. In every city and town, and in many villages, there is a considerable population living in homes entirely destitute of humanizing influences. The children of this class run at large, exercising their brutal and vicious instincts, and the unlimited slaughter of innocent birds is one of the results.

The evil being defined and located, the remedy is indicated. We look to the public schools for the redemption of Young America. The rapidly broadening scope which is being permitted in the work of the schools opens the way for a campaign of education.

Several lines of attack will at once suggest themselves to teachers and others who are interested. Some of these I will mention.

1. *Punishment of the guilty under such laws as exist for the protection of birds.* No teacher is likely to use this means except in extreme cases.

2. *Teaching beautiful sentiments about birds and bird life.* This is good so far as it goes. Kindly feelings are aroused and strengthened. But many hardened ones refuse to be touched and seize the first opportunity to show their defiance in a practical manner. At the best this course gives little real knowledge of the birds and the children remain strangers to them while they should have most intimate daily acquaintance. The proper place for such teaching is supplemental to the following.

3. *Close, accurate, continued study of birds, their ways, and their works.* By this procedure the work is given an intellectual basis. This method rests on a sound psychological principle. Any student of birds who can recall the impressions of his early studies knows that every new perception of beauty and adaptation in the structures of his specimens increased his regard for the living forms and restrained him from needless destruction of their lives even for legitimate purposes of study. The same key will open the way to the feelings of most boys. The glittering plumage in the bush excites the savage instinct to possess it. This interest is only momentary, and when the coveted object has been brought down by stone or shot it is soon flung aside. It would be a hundred times better if the boy shot birds to study them, but that is not necessary. Plenty of material may be collected without intentionally taking the life of a single bird, and we may hope to

make the bodies of birds objects of sacred regard to most boys so that they shall not wish to deprive them of life.

In every city a considerable number of birds meet accidental death every year, especially during the seasons of migrations. Many of these are picked up by the children while fresh and fit to handle. These unfortunate birds will become the source of most of our material. In any corps of teachers we would expect to find at least one with sufficient knowledge of taxidermy to prepare the skins suitably for preservation and study. Some of the older boys will gladly learn to do this work, and a few will become quite efficient, so that the labor will not only be taken off the hands of the teacher but will become of educational value to the pupils.

The deserted nests should be freely taken for study. After studying, in winter, the nests of last season, most pupils will be early on watch to see the new nests built. This will lead them to observe the more touching actions of the birds. At all times the teacher should be on the watch for opportunities to make direct appeal to the moral nature, but it should be done unobtrusively.

4. *Organize pupils into bird-protecting societies.* By this means unite all pupils, who are sufficiently awakened, in an effort to protect the birds and their nests, to provide nesting places for those species that come near human habitations, and to exert a restraining and educating influence on the thoughtless and vicious. By this means the few children who never enter the public schools could be watched and possibly influenced.

In an attempt to carry out the plan outlined above some difficulties and dangers must be met. Considerable knowledge of birds is necessary to the one who directs the undertaking. Details of method in the school room would occupy pages and would not be in place here. It is sufficient for the present to state that the writer knows where this plan is being tried with encouraging progress.

C. D. McLOUTH.

Muskegon, Mich., Dec. 16, 1893.

BIRD NOTES.

THE notes published in a recent issue of *Science* on "Birds Which Sing on the Nest" recalls an interesting instance of this kind that came to my notice last summer. It shows that the black-billed cuckoo is not always as quiet and retiring as we generally consider him. A pair of these birds built their nest in my friend's door-yard, so close to the house that it afforded a good opportunity to observe them. This pair were unusually loquacious, and throughout the period of incubation the bird on the nest was often heard holding a conversation with its mate lurking in the trees about the premises. When one bird flew to its perch on a certain tree, preparatory to flying to the nest, there was likely to be considerable chatter before it approached nearer. It is interesting to note that while some birds are quiet when incubating, as if to escape observation, their young often make considerable noise while yet in the nest. The flicker is a case in point. To merely hammer on the tree in which the nest is located is often enough to set the whole family going. I have also heard young bluebirds calling "*we-a-ry*" from their nest in a hollow stub. And, as for the young crow, his "*gobble, gobble, gobble,*" when being fed, is a well-known sound in the woods in spring, and often betrays the nest to the young bird's-nester.

WILLARD N. CLUTE.

Binghamton, N. Y., Dec. 13, 1893.

POSTAGE ON NATURAL HISTORY SPECIMENS.

IN your issue of Nov. 17, with reference to a ruling that natural history specimens cannot be transmitted through the mails as "samples" it is suggested that the various scientific bodies of the United States should use their influence to induce the governments of certain enumerated countries to consent to such material passing by sample post. It is sought to throw the blame upon the countries in question, whereas the trouble arises solely from the fact that the United States have not yet advanced far enough to have a *parcel post* as is in operation among these other countries. There is no difficulty in transmitting specimens from Canada to the most remote coun-

tries, but the United States by their policy make it impossible to receive or to send them. The scientific societies should exert their influence at home, and endeavor to have the United States Congress adopt the more advanced and liberal postal arrangements of the countries which your correspondents blame for their troubles.

W. HAGUE HARRINGTON.

Ottawa, Canada, Dec. 14, 1893.

A DICTIONARY OF SCIENTIFIC TERMS.

In answer to the query of B. S. Bowdish regarding a pronouncing dictionary of scientific names I would mention "A Manual of Scientific Terms," by Stormouth. Edinburgh, James Thin; London, Simpkin Marshall & Co. 1892. This is a small handy book of xi+488 pp., giving the pronunciation, derivation and definition of the terms used in botany, natural history, anatomy, medicine, etc., and contains an excellent appendix giving alphabetical lists of specific names, prefixes and postfixes with their definitions. I would consider it just the book for the purpose mentioned in the query.

WALTER C. KERR.

New Brighton, Staten Island, Dec. 12, 1893.

NOTES AND NEWS.

FIRE destroyed the contents of the stock room of the Salisbury Laboratory, Worcester Polytechnic Institute, Worcester, Mass., on the morning of Dec. 2. The new stock for the work of the current year had just been received, and much of it had been imported from Germany with no little pains by Dr. L. P. Kinnicutt and his assistants. The loss on the stock and apparatus amounts to $3,000, and the building was damaged to the extent of $1,500. There was ample insurance. Had it not been for the substantial character of the building, which is of brick, with brick partitions and wire-lath ceilings, the firemen would have been unable to save the structure. The stock room was in the fourth story. The Freshman laboratory adjoining was injured by smoke, and the chemical library below the stock room was damaged somewhat by water. It is believed that the fire was caused by an overheated chimney.

—The Board of Education of the city of Saginaw, Mich., has provided for a museum in connection with its East Side High School. This is now well under way and is to include departments of archæology, ethnology, ostiology, physiology, botany, zoölogy, chemistry, geology, history and economic industries. Part of the museum is to build up itself naturally by small accessions. Specimens will be transferred to this section only as they are illustrative of the branches in which instruction is given. In this way it is hoped the section may be developed, by the students themselves, into a typical High School museum entirely independent of the remaining specimens, which will be arranged more as a public museum, with attention to original research in the lines being investigated by citizens. An endeavor will be made that this museum shall *not* become a mere place for the storing of curiosities, but may be built up each step with a purpose into a teaching institution.

—The Iowa Academy of Sciences will meet in Des Moines, Iowa, Dec. 26 and 27, 1893. This Academy includes the active scientific workers of the state and a very interesting programme is prepared, including papers on the geology and natural history of the state, as well as papers in chemistry, physics and engineering. The meetings will be held in the Y. M. C. A. building, and all who are interested in the objects of the Academy are cordially invited to attend the sessions and take part in the discussions. The programmes may be obtained prior to the meeting by addressing the Secretary, Herbert Osborn, Ames, Iowa.

EXCHANGES.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Museum of Hamline University desires to exchange Marine Shells, preserved alcoholic material of marine zoology, or microscopic slides for zoological specimens from southern and western United States, especially for rodents in the flesh. Correspondence solicited. Address Henry L. Osborn, Biological Laboratory of Hamline University, St. Paul, Minnesota.

For Sale.—Small collection of fine first-class sets of birds' eggs; single breech-loading shotgun, gold-filled hunting-case watch and telescope. Write for list of eggs and particulars. B. S. Bowdish, Phelps, N. Y.

I am desirous of obtaining the following back numbers of *The Auk*: One copy each of Oct., 1885; July, 1886; January, 1887; July, 1887; April and July, 1891 and two copies each of the following: January, 1886 Oct. 1886; Oct., 1887; July, 1888; January, 1889; January, 1890. My own contributions in them only are required; otherwise the copies need not be perfect. I have in exchange for them two vols. (zoology) Mex. Bound'y Surveys (col. plates) or complete set of English reprints of "Osteology of Arctic Water-Birds, etc." (9 parts, 24 lith. plates); or other rare scientific reprints of any subject required. Address Dr. Shufeldt, Takoma, D. C.

For Sale.—The first eleven volumes of Crooke's Quarterly Journal of Science, 7 vols. 1st series, 4 vols. 2nd series, beautifully bound, half morocco, as good as new, for $30. John J. Jarmey, 93 Indianola Place, Columbus, Ohio.

For Sale.—A very fine telescope, length extended, twenty-five inches, closed, seven inches. Power twenty-five times. Good as new. Cost $25.00. Will sell for the best cash offer. B. S. Bowdish, Box 163, Phelps, N. Y.

Wants.

WANTED to exchange for human bones or recent medical text-books, the following books: "Metallurgy of Silver," M. Eissler, 1880; "Practical Treatise on Petroleum," by Benj. J. Crewe, 1887; "Cook's Chemical Philosophy," 1883; "Cairn's Chemical Analysis," 1880; "Wagner's Chemical Technology," by Crookes, 1886; "Presemier's Qual. Chem. Analysis," 1879; "Elementary Treatise on Practical Chemistry and Qual. Analysis."—Clowes, 1881; bound Vols. 1 to 12 of Dr. Lardner's "Museum of Science and Art" (very rare), 1854; back numbers of "Electrical World," beautiful specimens of Pyrite Incrustations from Cretaceous of New Jersey; Magnetis Iron Ore, Highly Polarized. Address D. T. Marshall, Metuchen, N. J.

WANTED.—Books or information on the microscopical determination of blood and hair. Also reports of cases where hair has played an important part in the identification of an individual. Address Maurice Reiker, 206 N. First Ave., Marshalltwn, Iowa.

A GEOLOGIST thoroughly conversant with the geology of the Southern States desires an engagement. Has complete knowledge of the economic geology of Iron, Coal, Lignite, as well as Clay and Kaolin. Five years' experience with Geological Surveys. Address K., 509 West Sixth Street, Austin, Texas.

WANTED.—Tuckerman's Geneva Lichenum and Carpenter on the Microscope, Wiley's Introduction to the Study of Lichens. State price and other particulars. Richard Lees, Brampton, Ont.

WANTED.—Icones Muscorum by W. D. Sullivant, with or without Supplement, but both preferred. Address, stating price and condition of books, Dr. G. N. Best, Rosemont, N. J.

SOME OF THE NEW BOOKS AT LOW PRICES.

FAMOUS VOYAGERS AND EXPLORERS.—$1.50.

MRS. BOLTON has added to her *Famous* series of books another and an unusually interesting volume, "Famous Voyagers and Explorers." It is hardly comprehensive, as it gives the biographies of only a few typical explorers—Marco Polo, Columbus, Magellan, Raleigh, and the more prominent of our modern American explorers. Doubtless such names as the Cabots, Sir Humphrey Gilbert, De Soto, Cartier, Nansen and others are reserved for a second volume. Mrs. Bolton has a gift for this sort of writing, and she has here brought together a large amount of deeply interesting matter which otherwise could only be obtained by reading through a dozen or more separate volumes. The book is illustrated with several portraits.—*Boston Transcript.*

OUR GREAT WEST.—$2.50.

THE contents of the volume appeared serially in *Harper's Magazine* and *Harper's Weekly*, in which periodicals they attracted wide attention and favorable comment. Their importance fully justified their republication in a more permanent form. The book affords a more minute insight into the present condition of the West than can be found elsewhere. What it tells is the result of personal experience, fortified by information obtained from the best-informed and most reliable men in the localities under discussion, and set forth with admirable clearness and impartiality. It is a work to be read and pondered by those interested in the growth of the nation westward, and is of permanent standard value.—*Boston Gazette.*

STATESMEN.—$2.00.

IN the preparation of this work Noah Brooks has aimed to present a series of character sketches of the eminent persons selected for portraiture. The object is to place before the present generation of Americans salient points in the careers of public men whose attainments in statesmanship were the result of their own individual exertions and force of character rather than of fortunate circumstances. Therefore these brief studies are not biographies. Mr. Brooks had the good fortune of personal acquaintance with most of the statesmen of the latter part of the period illustrated by his pen, and he considers it an advantage to his readers that they may thus receive from him some of the impressions which these conspicuous personages made upon the mental vision of those who heard and saw them while they were living examples of nobility of aim and success of achievement in American statesmanship.

MEN OF BUSINESS.—$2.00.

W. O. STODDARD, who has just written a book published by the Scribners, on "Men of Business," tells how the late Senator Stanford chopped his way to the law. "He had grown tall and strong," says Mr. Stoddard, "and was a capital hand in a hay-field, behind a plough, or with an axe in the timber; but how could this help him into his chosen profession? Nevertheless it was a feat of wood-chopping which raised him to the bar. When he was eighteen years of age his father purchased a tract of woodland; wished to clear it, but had not the means to do so. At the same time he was anxious to give his son a lift. He told Leand, therefore, that he could have all he could make from the timber, if he would leave the land clelar of trees. Leland took the offer, for a new market had latterly been created for cord-wood. He had saved money enough to hire other choppers to help him, and he chopped for the law and his future career. Over 2,000 cords of wood were cut and sold to the Mohawk and Hudson River Railroad, and the net profit to the young contractor was $2,600. It had been earned by severe toil, in cold and heat, and it stood for something more than dollars.—*Brooklyn Times.*

ORTHOMETRY.—$2.00.

IN "Orthometry" Mr. R. F. Brewer has attempted a fuller treatment of the art of versification than is to be found in the popular treatises on that subject. While the preface shows a tendency to encourage verse-making, as unnecessary as it is undesirable, the work may be regarded as useful so far as it tends to cultivate an intelligent taste for good poetry. The rhyming dictionary at the end is a new feature, which will undoubtedly commend itself to those having a use for such aids. A specially interesting chapter is that on "Poetic Trifles," in which are included the various imitations of foreign verse in English. The discussion of the sonnet, too, though failing to bring out fully the spiritual nature of this difficult verse form, is more accurate than might be expected from the following sentence: "The form of the sonnet is of Italian origin, and came into use in the fifteenth [*sic*] century, towards the end of which its construction was perfected, and its utmost melodious sweetness attained in the verse of Petrarch and Dante." In the chapter on Alliteration there are several misleading statements, such as calling "Piers the Plowman" an "Old English" poem. In the bibliography one is surprised not to find Mr. F. B. Gummere's admirable "Handbook of Poetics," now in its third edition. In spite of these and other shortcomings, which can be readily corrected in a later issue, this work may be recommended as a satisfactory treatment of the mechanics of verse. A careful reading will improve the critical faculties.—*The Dial.*